## Notebook, N-92-09-08

This notebook covers the period September 1892-March 1893. There is also one entry near the end of the book dated March 1892 [1893?]. The book was used by Joseph W. Harris primarily for notes regarding the electrolytic separation of iron ore and the bricking of ore concentrate. Also included are notes relating to routine chemical analyses, including assays of the stearic acid used in phonograph cylinders. The front cover is labeled "Experimental Notes & etc. J.W.H." The book contains 191 numbered pages and has been used in both directions.

Only the ore separation and bricking material has been filmed.

Filming order: 26-59, 66-73, 102-109, 167-126.

[illegible] 22 - 1892

Four samples of ore, Ogden Concentrates, Hematite, [illegible] mag., & [illegible] mag. [illegible] were ground to the shape of a cube inch & placed in a crucible packed with charcoal & [illegible] [illegible] [illegible] heated to redness & [illegible]

After heating for 3 hours blast was turned off, allowed to cool in charcoal & samples taken out. The Ogden cube had crumbled a little, & the crystaline was about to melt & run. The Hematite retained its shape.

The Crystaline seemed to be reduced easier than the others.

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Nov. 29th 1892

placed some pieces of magnetite & hematite iron ores in iron cylinder closed at one end, with tube leading from other end connected to gas jet, & also outlet tube at same end for escape of gas, in large furnace, and heated it to redness, passed gas through so that the ores would reduce. the idea being to ascertain if Ogden ore reduces better than other ores.

Made 4 expts. as above, all deposited carbon from the gas & the ores did not reduce as well as with air & Charcoal.

[illegible] turned on 1.15. P.M.

2.0

[illegible]

on [illegible] 2.0 (same lot)

[illegible]
100
200 hrs

with slight red heat.

On [illegible] of [illegible] ~~at~~ next morning, [illegible] had [illegible] on the surface.

Renewed expt with gasolene gas [illegible]

started 8.30

Expt with gasoline a failure

Placed number of [illegible] in boat with [illegible] & passed air through [illegible] became red hot.

Started 2.15
stopped 4.45
2.30

[illegible] Ch[illegible]

[illegible]

## No. 1

HCl experiments on reducing [illegible]

[illegible] hydrogen gas as reducer [illegible]

[illegible] Hydrogen

|  | before |  | after |  |
|---|---|---|---|---|
| Ogden | [illegible] | grams | 2[illegible] | grams |
| Hematite | [illegible] | " ([illegible]) | 18.800 | " |
| Granular | 35.5 | " ([illegible]) | 25.800 |  |
| Crystaline | 30.2 | " | 27.850 |  |

Started at 2.15
Stopped " 6.10

Ores as follows
Ogden, Hematite, Granular
Crystaline

[illegible] Expts with Ogden Co (71)

[illegible] & Hematite [illegible]

[illegible] were reduced all they [illegible] reduced, [illegible] the Crystaline reduced [illegible] on the surface, while the granular did not reduce at all. The order in which they stand [illegible]

Ogden
Hematite
Crystaline
Granular.

## No - 2

About 20 cc of $H_2O$ was given off.

|  | before |  | after |
|---|---|---|---|
| Ogden | 44.400 | grams, | 33.700 |
| Hematite | 44.900 | " | 39.700 |

Started at 10.00 Am.
stopped " 12.00 M.

Ogden first

Duplicate Expts. No. 3 with ores
[illegible] of hydrogen for a
short time of 1/2 hour.

| | before | | after | | % |
|---|---|---|---|---|---|
| Ogden | 21.900 | grams. | 18.5 | grams | 15.5 |
| Hematite | 21.000 | " | 19.3 | " | 9% |

Started 4.35
Stopped 5.10

Ogden Ore reduced Copper all through. Hematite did not reduce any.
Ogden first.

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Expt with Ogden & Crystaline ores. No. 4

| | before | after 12.00 o'clock. | lost |
|---|---|---|---|
| Ogden | 23.5 grams. | 19.5 grams | 17.7 |
| Crystaline | 25.2 grams | 23.3 " | 7.6 |

started 10.20
stopped 10.35
on opening, found that ores had

not been reduced.
started test again at
11.45
12.00
Ogden ore reduced copper solution throughout, while the crystaline ore reduced on the surface.
Crystaline first

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Expt No. 5

Expt with samples of 4 ores

| | | | after 1.40 o'clock | loss |
|---|---|---|---|---|
| Ogden | 35.5 | grams. | 32.5 grams | 8.5% |
| Hematite | 34.0 | " | broken | |
| Granular | 36.0 | " | 31.6 | 12% |
| Crystaline | 35.2 | " | 31.8 | 9.7% |

Started 9.27 Am
stopped at 10.00 "
after cooling, ore taken out, it was found that all had not been reduced
started again at 1.10
stopped at 1.40
Order of ores in tube,
Granular, Crystaline, Hematite, Ogden,

No - 6

Test with Ogden + Granulated ores
Granules being fired.

| | | | |
|---|---|---|---|
| Granules | 19.0 grains. | 17.3 grains | 9% |
| Ogden | 16.9 grains | 14.7 grains | 13% |

Started at 4.15
stopped " 4.45

No. 7

Test with Ogden + Hematite ores,
Hematite fired.

| | before | | after | % lost |
|---|---|---|---|---|
| [illegible] | [illegible] | grains | 21.9 | 24 |
| Hematite | [illegible]9.6 | " | 18.9 (broken) | 36 |

Started 9.10
Stopped 9.40

#8

4 samples, 2 Ogden, 2 Hematite, Heated with CO, from inside burner,
Samples alternately, thus

| | |
|---|---|
| #1 M | #1 H |
| #2 H | #2 M |

#1 Ogden 16.4
#2 " 18.7
#1 Hematite 10.55
#2 " 13.05
started 1.15 with CO at a dull red heat
stopped 2.45

#9 Reduced in Hydrogen

Test with 4 pieces Ogden, + 4 pieces Hematite, placed thus

| | |
|---|---|
| 1 H | 1 M |
| M 2 | H 2 |
| H 3 | M 3 |
| M 4 | H 4 |

H - Hematite
M - Magnetite - Ogden
Heated at a dull red heat,

started at 1-40
stopped 3.45
started 9 15
stopped 10 00

$$\frac{1-40}{4-30}$$

H -

| | | | | |
|---|---|---|---|---|
| 1 - | 19.9 - broken | | | |
| 2 - | 21.6 | 17.15 | - - - | lost 20.6% |
| 3 | 16.9 broken - | 13.4 | - - - " | 20.7 |
| 4 - | 23.7 | 19.9 | — " | 16% |

M -

| | | | | |
|---|---|---|---|---|
| 1 - | 19.5 | 16.6 | — | 14.9 |
| 2 | 17.25 | 15.6 | — | 9.6 |
| 3 | 18.05 | 16.35 | — | 8.9 |
| 4 | 20.3 - 18.7 | | — | 7.9 |

Started 10.15
stopped 10.45.

started again 1.30
stopped at 2.00
started 4 35
stopped 5 15

Qualitative determination of [illegible] of steel [illegible]

[illegible] K

[illegible] 616

HCl, leaves a black residue, which [illegible] the [illegible]

$H_2S$ [illegible] ppt which [illegible]

$(NH_4)_2S$ produces black ppt.

Ammon. Carbonate produces no ppt.

| Contains | does not contain |
|---|---|
| Iron | Ni |
| tungsten, | Co |
| Phos | Ti |

Quantitative determination of tungsten in above steel

Weight of sample, 3.423 grams digested in $HNO_3$ + HCl.

# H 10

Samples of Clues, heated with CO gas
four of each, as in H 9 –

M –

|  |  |  | lost |
|---|---|---|---|
| 1 | – 17.1 | 16.5 | 3.5 % |
| 2 | 16.45 | 16.0 | 3.4 % |
| 3 | 18.45 | 17.8 | 3.6 % |
| 4 | 18.6 | 18.15 | 2.5 % |

H –

|  |  |  |  |
|---|---|---|---|
| 1 | 26.6 |  |  |
| 2 | 32.45 | 20.3 | 37.4 (?) |
| 3 | 15.45 | 13.8 | 10.7 |
| 4 | 17.1 | 15.5 | 9.4 |

Started 8-50

stopped 11-50

#11

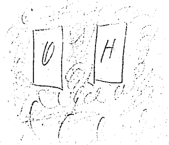
Two samples, Hematite & Magnetite

M- [illegible].40

H, [illegible].6

started at 10 45 Am –
stopped " 11 00
stopped 1 00
stopped 6 00

Each piece surrounded by charcoal, so as to reduce CO$_2$, & oxidize O. thus



started again 7 45

Red heat=

On removing [illegible] found that Hematite had been reduced to magnetite, while magnetite remained unchanged. Tried covering with charcoal & passing air through.

41

furnace started
1.45

Experiments on bucking to be made in the following proportions

6½ lbs Rosin
90 lbs water
5½ lbs Lelande soda

after clear, dilute with 150 lbs water, & boil till clear.

used

124 grams Rosin
150 " $H_2O$
11 " $Na_2O$

300 " $H_2O$ extra

# 2

124 Rosin
180 $H_2O$
14 Soda

300 grams $H_2O$ extra

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# 3

124 Rosin
180 $H_2O$
11 Soda

150 grams $H_2O$ extra

#4

| | |
|---|---|
| 62 | Rosin |
| 180 | $H_2O$ |
| 11 | Soda |
| 150 | $H_2O$ [illegible] |

#5

| | |
|---|---|
| 124 | Rosin |
| 180 | water |
| 11 | Soda |
| 150 | $H_2O$ [illegible] |

# 6

22 grams Calcium Chloride fused
124 " Rosin
180 " $H_2O$
150 " $H_2O$ extra
11 " Soda

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# 7

64 gram fine powdered Rosin
5½ gram fresh Soda
90 cc. water,
after all combined, & still boiling
add gradually, 80 cc $H_2O$.
Weight of total mass & can 960 grams
" " can 462 "
498 " much
used 3 times quantity of material,
718.5 grams.
498.0
220.5

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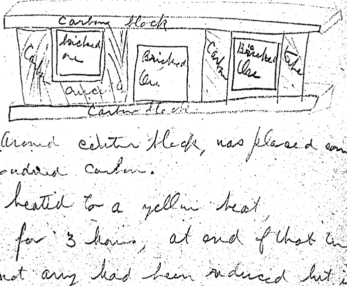
Jan 3 - 1892

Experiments on reducing Ogden bricked ore, in presence of carbon only,

3 pieces of ore tried, as follows

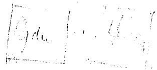

Carbon block
bricked ore
Bricked Ore
Bricked Ore
Carbon
Carbon
Carbon
air gap
Carbon block

Around center block, was placed some powdered carbon.
heated to a yellow heat,
for 3 hours, at end of that time not any had been reduced but it appears as if it would have reduced if heated for, say, 10 hours.

Experiment on reducing Ogden
nickel concentrates & a piece of hematite
in Hydrogen gas.

|  | before | after |  |
|---|---|---|---|
| Ogden | 45.8 | 41.4 | lost 9.6% |
| Hematite | 37.6 | 34.0 | " 9.6% |

placed side by side



started at 11.00 am
stopped " 12.00 "

Cooled in an atmosphere of
Coal gas
Hematite reduced to magnetite
Started again at 2.45
stopped at 4.45

|  |  |  | lost |
|---|---|---|---|
| O - | 41.4 | 37.250 | 10% |
| H - | 34.0 | 32.1 | 5.6% |

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(49)

# 8 muck.
as # 7 repeated.

64 fine rosin
5½ Soda
90 cc $H_2O$

+ after all combined,
80 cc $H_2O$

Weight of clean dish, in which material will be made, 303 grams.
after dissolving soda in the water dish, water + soda weighed 399.5 grams
(probably added 91 cc $H_2O$, instead of 90)
Weight after adding rosin, & combining same, 418.5 grams.
after adding 80 cc $H_2O$ extra = 492 gms
Total weight of material, 239.5
Loss % = 21%
Loss in adding the 80 cc $H_2O$, 7.5%

#9 -

115cc $H_2O$
64 grams Rosin
5½ " Soda
+ 86cc $H_2O$ extra.

Weight of dish, 312 grams.
" " ", water + Soda 432.5 "

After extra $H_2O$ added 532
Afterwards, added, 19cc. = 546.5
5cc = 551 grms.

Total cc $H_2O$ added
115
86 or, 115 + 110
24
225 cc.

In using standard solution of soda (192.5 grams Soda, + 402.5cc $H_2O$) 112cc = 120.5 grams. (This is due to the contraction the water undergoes, by adding soda)
Therefore
112 cc Std Soda Sol.
64 Rosin
110 $H_2O$ extra.

## #10

Experiment to determine the necessary quantity of Soda solution to secure, for combining the precipitated resin.

49.5 cc Soda Sol
32 Rosin
55 $H_2O$ extra
5.5 cc Soda Sol (10%)

## #11

47 cc Soda Sol
32 Rosin
55 $H_2O$ Extra
8 Soda Sol (15%)

#12

44 cc Soda Sol
32 Rosin
55 $H_2O$ Extra
11 cc Soda Sol (40%

#13

41 cc Soda Sol
32 Rosin
55 $H_2O$ extra
14 cc Soda Sol. (25%)

## #14

38.5 cc Soda Sol
32 Rosin
55 $H_2O$ [illegible]
16.5 cc Soda Sol (20%)

## #15

115 $H_2O$.
6 Soda
64 Rosin
110 $H_2O$
(20% Soda Sol reserved)

When soda was dissolved in the 115 cc $H_2O$, its volume was measured = 113 cc.

Sp. G. of resinate, at 150° F, should be 1.035 Baume

Jan 11th

[illegible] Remarks.

[illegible] filled and checked

with air [illegible] for [illegible]

lost

Ogol 44.030 grams 35.1 20%

Hem [illegible] 33.2 25%

Orange [illegible]

Started 11-30

Stopped 12.00

Started 12.50

Stopped 3.00

Sprinkler system went off &

[illegible] experiment.

59

To HCl sol. of metal, BaCl gives a very faint crystalline ppt, which indicates trace of [illegible]

Examination of a solution of Ogden magnetic iron ore, for all elements –

Dissolved 500 grams ore in HCl + $HNO_3$ diluted a portion, added $H_2S$ in excess, gave ppt of sulphur, seemed also to give arsenic, + after considerable $H_2S$ had been added, a very deep blue color was produced which disappeared. This blue is vanadium;

Dissolved ppt of Sulphur etc, in $HNO_3$

Contains

no

copper

zirconium

chromium

zinc

antimony

manganese

molybdenum

iron

arsenic

aluminum

Phos.

Sulphur

silica

Cobalt

nickel

vanadium

Calcium

trace titanium

trace tungsten

fused 10 grams ogden ore with Sodium Carbonate, + a little Sodium Nitrate in pt. Crucible, for vanadium + dissolved fused mass in H.2O, filtered, used filter for determination of Ni + Co.

Pt Crucible, weighs 22.777 grams

" " " with Ni + Co 22.798 "

.021 "

Paper 001

.00.020 "

= 78.57

00.13714

= 0.157% of Ni + Co

22.777

22.783

.006 grams

.5616

33696 = 0.0336962% vanadium

= 13.8 20 per ton

analysis of a copper ore, found at
~~Hodtown~~, Hodtown, by Mr. Burn
5 grams used: = 1.92 % Cu,

51.7 cc
72.5 "
20.8
1.2
19.6 cc
4.897
29382
44073
4897
5000 ) 95.9812 mg
1.92
5000
.96
30000
45000
48.0000

Test of ore mixing machine,
run slowly about 35 revs. per min,
and 50 lbs ore, regular muck,
90 lbs per ton, took about 7 minutes
for all to pass, through, after all
had passed, mixture weighed
40 lbs. mixture well sieved,
& balls weighed = 690.

Test on Feb - 8th 1892

Machine geared up. 225 lbs ore put in, with muck, this, practically, is the limit of this machine, it made a layer of about 2½" all along the bottom, & had the effect of mixing under pressure, as one particle of ore would grind against all others. Speed 26 revs per minute. sieved a portion gave no balls, only hard pieces which was fast to the machine, & large grains of sand, remained.

Experiments on making Resinate of Soda with Carbonate of Soda & Calcium Hydrate,

1 part $Na_2O$ = 1.7 parts $Na_2CO_3$

1.7 parts $Na_2CO_3$ require 1.19 parts $Ca(OH)_2$ to liberate 1 part $Na_2O$

1.7
1.7 ) 900.0 ( 53
85
50

Experiments on mixing &c.

#1

Burning Oil —

15 lbs - oil

30 " Rosin —

mixed first —

Oil hot about 225° —

mixed very well - all right

#2 —

Lima Oil -

15 lbs oil

30 " Rosin mixed first

Oil hot - about 200

mixed in machine all right

#3

12 lbs Lima Oil
30 " Rosin
mixed fused –
Use cold –
did not mix at all

#4

12 lbs Lima Oil
30 lbs Rosin
Mixed fused
Use at 120°F
did not mix very well –

#5

15 lbs Lima Oil
30 " Rosin
mixed first
Also cold -
no good

#6

12 lbs Lima Oil.
30 " Rosin
mixed first
Also at 150°F -
mixed very well, perfectly satisfactory

Examination of Rosin for Acids

Sample of very transparent yellow rosin, probably G or K used as standard, 2 grams weighed and dissolved in alcohol and neutralized by a solution of $NaOH + H_2O$ = 20.0 cc. or 100%

Sample of regular B rosin, 2 grams used & neutralized by same NaOH solution = 19.3 cc = 96.5%

Sample of Dross Rosin, 2 grams used & neutralized by same NaOH solution = 17.7 cc, or 88.5%

Or, using B Rosin as standard,
B = 100%
Dross Rosin = 91.7%
Residue in Dross rosin (of 2 grams) = 0.234 mg = 12.7% + 88.5% = 101.2%

#18 2'8"

Round bottom, flat top —
paked mould
2 blows.
broken around bottom on
napped side

#19 2'8"

Same as #18 -
3 blows

napped sides —
broken around bottom

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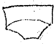
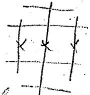
#17 2'8"

Packed mould —
1 ~~drop~~ - blow —
Round bottom, flat top
napped sides.
Broken across bottom,



# 21    2' p4

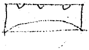
pieces placed top & bottom
but crossed



2 blows

sides rapped

split across bottom



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# 20    2' p4

pieces placed top & bottom
are not packed

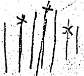
3 pieces top
4 " bottom

1 blow

rapped sides

pieces in same direction

cake was very weak.



x means top piece

# 23 2'8"

same as 22, but are rammed -

3 blows

top end broken

bottom end also broken

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# 22 2'8"

same as # 21, but 3 blows

1 5/8" from top of iron to top of mould before ramming,

after ramming, distance is 11/16"

depth of cake after compress

2"

broke across top end

# 25 3'

Height raised from 2'8" to
3 feet

flat bottom & top

mould rammed

3 flaws

very good brick

# 24 2'8"

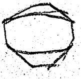
Round top & Bottom

rammed mould - with
small ram rod

3 flaws

rapped mould

broke both ends



#27 3'

flat top & bottom

3 blows —

lack of [illegible] ~~[illegible]~~ thickness

not rammed —

split across bottom

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#26, 3' 1/4" – 7/16"

flat top & bottom (N9)

3 blows — mould not rammed

split across the top & bottom

#29

Mould with pieces crossed, without ramming - -

3 blows -

Mould rapped

split across top & bottom

#28

same as #27, but mould rammed - 3 blows -

mould rapped -

split across bottom

H 31

flat top & bottom

5 blows mould rammed —

sides rapped

split in bottom

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H 30

same as 29

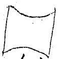
with mould rammed —

3 blows

split in top —

#33

Mould filled to top, not rammed.
Concave ends



to mould,

3 Hours. Thick brick .3" cake
separated on top -
rapped mould

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#32

3 Hours.
flat top & bottom
paper on top, bottom, & sides
to find out if its sticking to metal
is cause of splits.
Mould rapped
split across bottom & top.

#35

flat bottom flat top with holes at top –

3 flows –

rapped mould 1" thick

split around top, but line in cake around bottom

#34

same as 33 but not so much oil, 3 flows 1" cake

rapped mould –

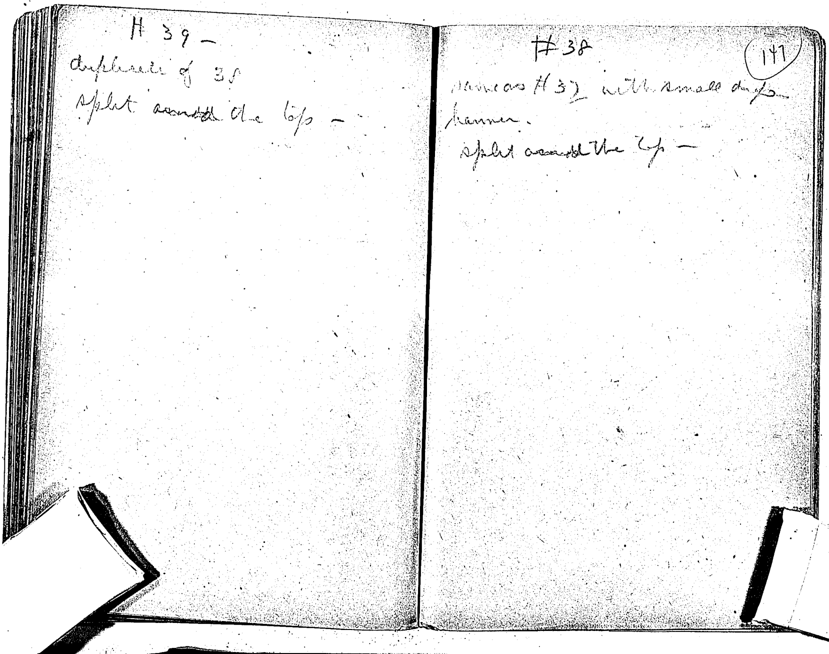
broken around the bottom –

37 -

small cast iron mould with plunger filled up, 1 days broke all to pieces on removing - too much of a blow -

#36

Same as 35, with ore rammed - 3 blows - 1" cake split on top, & had line around the bottom -



H 39 —

duplicate of 38

split around the lips —

#38

same as H 37 with small drop hammer.

split around the lip —

# 41

Same as 40, under heavy hammer - 1 blow - rammed mould -

split across mould -

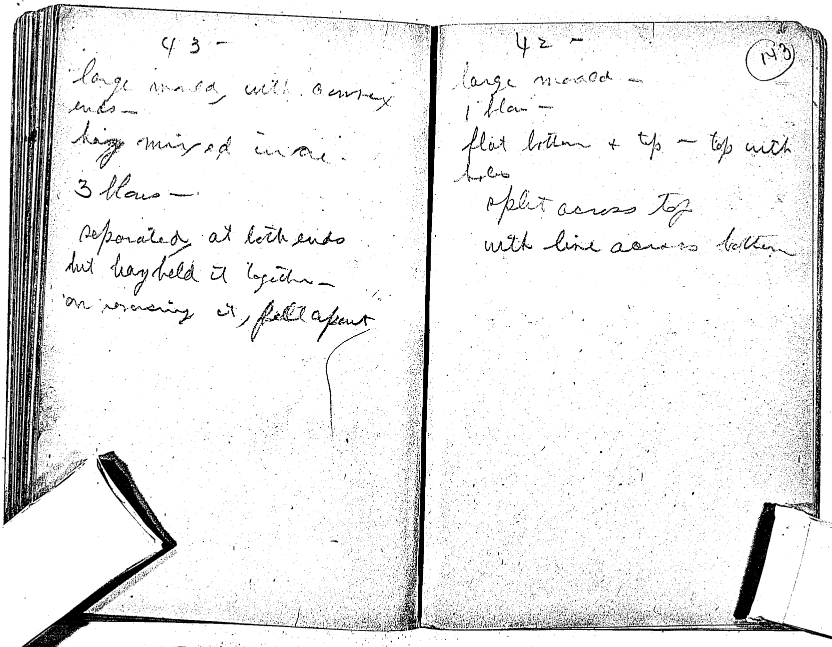
# 40 -

same as 39 with reversed plunger

better than 39 but ~~[illegible]~~

split across middle -

2 blows -



43 —

large mass with convex ends —

hay mixed in one.

3 flaws —

separated at both ends
but hay held it together —
on removing it, fell apart

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42 —

large mass —

1 flaw —

flat bottom + top — top with holes

split across top
with line across bottom

45.

same as 44 –
5 flaws –
separated + cracked all up –

#44

same as 43 – with 1 flaw –
split across top, line across
bottom, worse than 43 –
very large

Very large vase flat ends
holes at the bottom large
quantity of hay —
3 blues — cake 2½"
cracked across top —
& bottom, & all over

large mound — 3 blues -
used hay —
flat ends holes on top -
cracked across top

49 –

flat ends, holes at bottom,
3 hrs –
moved held still by
hand
[illegible] in [illegible]

48 –

same as 47, with less
bay – 3 hrs –
split across top, lines
all through –

51 —

Same as 50 — 1 Blue —
split across top —
~~[illegible] across top~~ ✓
lines across bottom ..

50 —

same as 49 — with less
air —
3 blue
split across top —

53 —

Same as 52
longer wick, &
more water
3 blisters —

---

52 —

Same as 51 — with wire
dampened — 3 blues —

55

very thin Bands
wet one –

54

2 Hours thin clouds
very good –

convex [illegible]
2 stems —
wet air
hard in centre
soft outside
split across the middle
no lines.

small [illegible]
1 Blue —
wet air

59

flat ends, — thin one,
2 blows, bay mixed
with wet one
split across top —
& all around.

58 —

flat ends. hollow at the
bottom 2 blows —
very good